

In the Claims:

Please amend the claims as follows:

1. (currently amended) A method for determining a position ($P_{xyz}(MT)$) of a signal transmitter, the method (MT) comprising the steps of:

receiving a direct sequence spread spectrum signal (S_{MT}) from the transmitter (MT) in each of at least three physically separated sensors (100a, 100b, 100c, 100d) whose respective positions are known, the signal (S_{MT}) representing a set of symbols,

correlating, in each of the sensors (100a, 100b, 100c, 100d) a representation ($S_{BB}, \ll S_{BB} \gg$) of the received signal (S_{MT}) with at least one local spreading sequence (S_{PP}, S_{bin}) to determine a respective estimated transmission delay (d) of the received signal (S_{MT}), the received direct sequence spread spectrum signal (S_{MT}) having a nominal chip period (T_C), the correlating step producing a chip level synchronization at least within an uncertainty region of one half nominal chip period ($T_C/2$), and

calculating a distance (D_{MT-100}) between the signal transmitter (MT) and each of the at least three sensors (100a, 100b, 100c, 100d) based on the respective estimated transmission delays (d),

wherein the correlating step comprising the further sub-steps of: comprises:

over-sampling the representation (S_{BB}) of the received signal (S_{MT}) within the uncertainty region to obtain a corresponding over-sampled representation of the received signal ($\ll S_{BB} \gg$), the over-sampling being equivalent to a reduced chip period (T_{C1}) which is shorter than the nominal chip period (T_C),

selecting a local spreading sequence (S_{PP}) containing poly-phased symbol values which are different from the set of symbols represented by the received signal (S_{MT}), the selected local spreading sequence (S_{PP}) having a nominal chip period being equivalent to the reduced chip period (T_c), and

cross-correlating the over-sampled representation ($\langle S_{BB} \rangle$) of the received signal (S_{MT}) with the selected local spreading sequence (S_{PP}) to obtain an improved uncertainty region which is more limited than one half nominal chip period ($T_c/2$).

2. (currently amended) The method A-method according to claim 1, wherein prior to said cross-correlating ~~sub-step~~, the correlating step involving further comprises an auto-correlating ~~sub-step~~ wherein the representation (S_{BB}) of the received signal (S_{MT}) is correlated with a local copy (S_{bin}) of the transmitted spreading sequence to provide an uncertainty region of one half nominal chip period ($T_c/2$) around an auto-correlation peak (501).

3. (currently amended) The method A-method according to claim 1, further comprising the steps of:

examining a phase difference function ($\Delta\phi$) which describes a phase difference between neighboring samples in a cross-correlation function resulting from said cross-correlating ~~sub-step~~,

detecting a position (P) in said phase difference function ($\Delta\phi$) where the phase difference between neighboring samples exceeds a predetermined magnitude ($\Delta\phi_{th}$), and

defining the improved uncertainty region adjacent to samples in the over-sampled representation of the received signal ($\langle S_{BB} \rangle$) equivalent to said position (P).

4. (currently amended) The method A according to claim 1, wherein the improved uncertainty region ~~having has~~ an extension which is equal to one half reduced chip period ($T_{ch}/2$).

5. (currently amended) The method A according to claim 1, wherein the over-sampling, the selecting a local spreading sequence, and the cross-correlating are repeated repeating said further sub-steps with progressively reduced chip periods and uncertainty regions until a desired limitation of the uncertainty region is achieved.

6. (currently amended) The method A according to claim 5, wherein the reduced chip period (T_{ch}) with respect to a first over-sampling ~~representing represents~~ an over-sampling by an integer factor of the transmitted direct sequence spread spectrum signal (S_M), said integer factor being larger than one.

7. (currently amended) The method A according to claim 6, wherein the reduced chip period (T_{ch}) with respect to any subsequent over-sampling after the first over-sampling ~~representing represents~~ an integer factor times a foregoing over-sampling, said integer factor being larger than one.

8. (currently amended) The method A according to claim 1, wherein the over-sampling ~~involving comprises~~ a linear interpolation between neighboring sampling points.

9. (currently amended) The method A~~method~~ according to claim 1, wherein the over-sampling ~~involving~~ comprises one or more repetitions of each sampling value.

10. (currently amended) A computer program directly loadable into the internal memory of a computer, comprising:

program code for determining a position ($P_{xyz}(MT)$) of a signal transmitter (MT), the program code comprises sets of instructions for:

receiving a direct sequence spread spectrum signal (S_{MT}) from the transmitter (MT) in each of at least three physically separated sensors ($100a, 100b, 100c, 100d$) whose respective positions are known, the signal (S_{MT}) representing a set of symbols,

correlating, in each of the sensors ($100a, 100b, 100c, 100d$) a representation ($S_{BB}, \ll S_{BB} \gg$) of the received signal (S_{MT}) with at least one local spreading sequence (S_{PP}, S_{bin}) to determine a respective estimated transmission delay (τ) of the received signal (S_{MT}), the received direct sequence spread spectrum signal (S_{MT}) having a nominal chip period (T_C), the correlating step producing a chip level synchronization at least within an uncertainty region of one half nominal chip period ($T_C/2$), and

calculating a distance (D_{MT-100}) between the signal transmitter (MT) and each of the at least three sensors ($100a, 100b, 100c, 100d$) based on the respective estimated transmission delays (τ), wherein the correlating step ~~comprising the further~~ comprises: sub-steps of:

over-sampling the representation (S_{BB}) of the received signal (S_{MT}) within the uncertainty region to obtain a corresponding over-sampled representation of the received signal ($\ll S_{BB} \gg$), the over-sampling being equivalent to a reduced chip period (T_{Cl}) which is shorter than the nominal chip period (T_C),

selecting a local spreading sequence (S_{PP}) containing poly-phased symbol values which are different from the set of symbols represented by the received signal (S_{MT}), the selected local spreading sequence (S_{PP}) having a nominal chip period being equivalent to the reduced chip period (T_c), and

cross-correlating the over-sampled representation ($\ll S_{BB} \gg$) of the received signal (S_{MT}) with the selected local spreading sequence (S_{PP}) to obtain an improved uncertainty region which is more limited than one half nominal chip period ($T_c/2$).

11. (currently amended) A computer readable carrier medium, having a program code recorded thereon, wherein the program code includes sets of instructions comprising:

first computer instructions for receiving a direct sequence spread spectrum signal (S_{MT}) from the transmitter (MT) in each of at least three physically separated sensors (100a, 100b, 100c, 100d) whose respective positions are known, the signal (S_{MT}) representing a set of symbols,

second computer instructions for correlating, in each of the sensors (100a, 100b, 100c, 100d) a representation ($S_{BB}, \ll S_{BB} \gg$) of the received signal (S_{MT}) with at least one local spreading sequence (S_{PP}, S_{bin}) to determine a respective estimated transmission delay (d) of the received signal (S_{MT}), the received direct sequence spread spectrum signal (S_{MT}) having a nominal chip period (T_c), the correlating step producing a chip level synchronization at least within an uncertainty region of one half nominal chip period ($T_c/2$), and

third computer instructions for calculating a distance ($D_{MT,100}$) between the signal transmitter (MT) and each of the at least three sensors (100a, 100b, 100c, 100d) based on the respective estimated transmission delays (d), wherein the correlating step comprising the further

sub-steps of: comprises:

forth computer instructions for over-sampling the representation (S_{BB}) of the received signal (S_{MT}) within the uncertainty region to obtain a corresponding over-sampled representation of the received signal ($\ll S_{BB} \gg$), the over-sampling being equivalent to a reduced chip period (T_{CI}) which is shorter than the nominal chip period (T_C),

fifth computer instructions for selecting a local spreading sequence (S_{PP}) containing poly-phased symbol values which are different from the set of symbols represented by the received signal (S_{MT}), the selected local spreading sequence (S_{PP}) having a nominal chip period being equivalent to the reduced chip period (T_{CI}), and

sixth computer instructions for cross-correlating the over-sampled representation ($\ll S_{BB} \gg$) of the received signal (S_{MT}) with the selected local spreading sequence (S_{PP}) to obtain an improved uncertainty region which is more limited than one half nominal chip period ($T_C/2$).

12. (currently amended) A sensor (100) for determining a distance (D_{MT-100}) to a signal transmitter (MT) based on a direct sequence spread spectrum signal (S_{MT}) received from the transmitter (MT), the signal (S_{MT}) representing a set of symbols, the sensor (100) comprising:

a timing unit (220) adapted to determine an estimated transmission delay (δ) of the received signal (S_{MT}) based on a correlation between at least one representation ($S_{BB}, \ll S_{BB} \gg$) of the received signal (S_{MT}) and at least one local spreading sequence (S_{PP}, S_{bin}), the received direct sequence spread spectrum signal (S_{MT}) having a nominal chip period (T_C), the timing unit (220) being adapted to produce a chip level synchronization at least within an uncertainty region of one half nominal chip period ($T_C/2$), and

a calculating circuit (230) adapted to calculate the distance (D_{MT-100}) on the basis of based

on the transmission delay (Δt) produced by said timing unit (220), wherein the timing unit (220) comprises:

a sampling circuit (221) adapted to over-sample the representation (S_{BB}) of the received signal (S_{MT}) within the uncertainty region to produce a corresponding over-sampled representation ($\ll S_{BB} \gg$) of the received signal (S_{MT}), the over-sampling being equivalent to a reduced chip period (T_{CI}) which is shorter than the nominal chip period (T_C),

at least one bank of spreading sequences (223a) adapted to provide a local spreading sequence (S_{PP}) containing poly-phased symbol values which are different from the set of symbols represented by the signal (S_{MT}), said local spreading sequence (S_{PP}) having a nominal chip period which is equivalent to the reduced chip period (T_{CI}), and

a correlating circuit (222) adapted to cross-correlate the over-sampled representation ($\ll S_{BB} \gg$) of the received signal (S_{MT}) with said local spreading sequence (S_{PP}) to obtain an improved uncertainty region being more limited than one half nominal chip period ($T_C/2$).

13. (currently amended) The sensor A ~~sensor~~ (100) according to claim 12, wherein the timing unit (220) is adapted to, before cross-correlating the over-sampled representation ($\ll S_{BB} \gg$) of the received signal (S_{MT}) with said local spreading sequence (S_{PP}), auto-correlate the representation (S_{BB}) of the received signal (S_{MT}) with a local copy (S_{BB}) of the transmitted spreading sequence from the at least one bank of spreading sequences (223b) such that a chip level synchronization is obtained within an uncertainty region of one half nominal chip period ($T_C/2$) around an auto-correlation peak.

14. (currently amended) The sensor A ~~sensor~~ (100) according to claim 12, ~~wherein it~~

comprises further comprising:

a control circuit (240) adapted to control the timing unit (220) such that for a particular representation (S_{BB} , $\leftarrow S_{BB} \rightarrow$) of the received signal (S_{MT}) the at least one bank of spreading sequences (223a, 223b) provides an appropriate local spreading sequence (S_{PP} ; S_{bin}) to the correlating circuit (222).

15. (currently amended) A system for determining a position ($P_{xyz}(MT)$) of a signal transmitter (MT) transmitting a direct sequence spread spectrum signal (S_{MT}), the system comprising:

at least three physically separated sensors (100a, 100b, 100c, 100d), each sensor being adapted to receive the signal (S_{MT}) transmitted from the signal transmitter (MT), the respective position of each sensor being known, and

a central node (110) adapted to receive distance data (D_{MT-100}) from each of the sensors (100a, 100b, 100c, 100d), the distance data (D_{MT-100}) representing a respective distance between the transmitter (MT) and the sensor (100a, 100b, 100c, 100d), wherein each of the sensors (100a, 100b, 100c, 100d) ~~is the sensor (100) according to claim 12 comprises:~~

a timing unit adapted to determine an estimated transmission delay of the received signal based on a correlation between at least one representation of the received signal and at least one local spreading sequence, the received direct sequence spread spectrum signal having a nominal chip period, the timing unit being adapted to produce a chip level synchronization at least within an uncertainty region of one half nominal chip period, and

a calculating circuit adapted to calculate the distance based on the transmission delay produced by said timing unit, wherein the timing unit comprises:

a sampling circuit adapted to over-sample the representation of the received signal within the uncertainty region to produce a corresponding over-sampled representation of the received signal, the over-sampling being equivalent to a reduced chip period which is shorter than the nominal chip period,

at least one bank of spreading sequences adapted to provide a local spreading sequence containing poly-phased symbol values which are different from the set of symbols represented by the signal, said local spreading sequence having a nominal chip period which is equivalent to the reduced chip period, and

a correlating circuit adapted to cross-correlate the over-sampled representation of the received signal with said local spreading sequence to obtain an improved uncertainty region being more limited than one half nominal chip period.